PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

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PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing (*day/month/year*)	08 JUL 2008
Applicant's or agent's file reference (ANA-278PC)	**FOR FURTHER ACTION** See paragraph 2 below

International application No.	International filing date (*day/month/year*)	Priority date (*day/month/year*)
PCT/US 08/52326	29 January 2008 (29.01.2008)	29 January 2007 (29.01.2007)

International Patent Classification (IPC) or both national classification and IPC
IPC(8) - H01F 21/06 (2008.04)
USPC - 336/130

Applicant ANALOGIC CORPORATION

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/US	Date of completion of this opinion	Authorized officer:
Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	01 July 2008 (01.07.2008)	Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

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Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:

   ☒ the international application in the language in which it was filed.

   ☐ a translation of the international application into ____________________ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of:

   a. type of material

   ☐ a sequence listing

   ☐ table(s) related to the sequence listing

   b. format of material

   ☐ on paper

   ☐ in electronic form

   c. time of filing/furnishing

   ☐ contained in the international application as filed

   ☐ filed together with the international application in electronic form

   ☐ furnished subsequently to this Authority for the purposes of search

4. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table(s) relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

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Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	12-14, 18-22, 24, 32, 41-51	YES
	Claims	1-11, 15-17, 23, 25-31, 33-40, 52-59	NO
Inventive step (IS)	Claims	None	YES
	Claims	1-59	NO
Industrial applicability (IA)	Claims	1-59	YES
	Claims	None	NO

2. Citations and explanations:

Claims 1-11, 15-17, 23, 25-31, 33-40 and 52-59 lack novelty under PCT Article 33(2) as being anticipated by US 2006/0022785 A1 (Dobbs).

Regarding claim 1, Dobbs discloses a shielded power coupling device (para [0015]) transferring electric power between a stationary subsystem and a rotatable subsystem (para [0009]) that is inductively coupled to (para [0033]) and arranged in close proximity to the stationary subsystem (Fig. 4A and 4B) and that, during operation of the shielded power coupling device, is capable of rotating about an axis of rotation which is also substantially an axis of symmetry for both the stationary subsystem and the rotating subsystem (rotation of cores about a common axis as described in para [0028]), the shielded power coupling device comprising:
a) an inductive field generating element capable of converting electric power to an inductive coupling field (inherent - where power coupling device 10 in Fig. 1 and 2A - 2B as described in para [0037] would include a generating element);
b) an inductive coupling field receiving element capable of converting the inductive coupling field to electric power (inherent - where power coupling device 10 in Fig. 1 and 2A - 2B as described in para [0037] would include a receiving element);
c) an inductive coupling efficiency increasing element capable of increasing inductive coupling between the inductive field generating element and the inductive coupling field receiving element (use of ferrite cores surrounding each winding in para [0017] which applicant considers capable of increasing inductive coupling); and
d) shielding peripheral to the inductive coupling efficiency increasing element (see shields 300 and 310 in Fig. 6A and 6B described in para [0048]) that is capable of substantially eliminating leakage of electromagnetic radiation from the shielded power coupling device (leakage prevented as described in para [0050]) when the shielded power coupling device is operated at power levels exceeding 2.5 kW (use of coupling device at 5 kW in para [0040]).

Regarding claim 2, Dobbs discloses a shielded power coupling device (para [0015]) transferring electric power between a stationary member and a rotating member (para [0009]), the shielded power coupling device comprising:
a) a reluctance-decreasing primary core defining a first primary core recess (see primary core 100 defining a recess 110 in Fig. 1 as described in para [0027]);
b) a reluctance-decreasing secondary core disposed adjacent the primary core and defining a first secondary core recess (see secondary core 200 that defines second recess 210 in Fig. 1 as described in para [0027]), the primary core and the secondary core being arranged so as to form a core airgap therebetween permitting relative rotation of the primary core and the secondary core about an axis of rotation (see airgap 150 described in para [0028]);
c) a first electrically conductive primary winding disposed substantially within the first primary core recess (see winding 120 in Fig. 1 as described in para [0027]);
d) a first electrically conductive secondary winding disposed substantially within the first secondary core recess (see winding 220 in Fig. 1 as described in para [0027]; and
e) a shield (see shields 300 and 310 in Fig. 6A and 6B as described in para [0046]);
f) wherein a first primary electric current flowing through the first primary winding produces a first secondary electric current flowing through the first secondary winding (para [0033]), creating a fringing field at the periphery of the core airgap (where magnetic fields are induced just outside the surface of the cores as described in para [0047]); and
g) the shield substantially cancels the fringing field (where shields cancel magnetic fields induced just outside the surface of the cores as described in para [0047]).

Regarding claim 3, Dobbs further discloses wherein the shield forms at least one substantially continuous electrical path constituting a closed electric circuit around the axis of rotation (see Fig. 3 with Fig. 6A).

Regarding claim 4, Dobbs further discloses wherein the shield forms at least one substantially circular electrical path constituting a closed electric circuit around the axis of rotation (see Fig. 3 with Fig. 6A).

Regarding claim 5, Dobbs further discloses wherein the shield comprises electrically conductive material (use of aluminum as shield in para [0046]) in at least one ring-like band adjacent to and alongside the core airgap (see shield 300 in Fig. 6A that would continue and be adjacent to air gap 150 as shown in Fig. 1).

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Regarding claim 6, Dobbs further discloses wherein the shield has electrically conductive material at such locations and in such electrical conductivity or conductivities and thickness or thicknesses as is sufficient to support electric currents capable of inducing a magnetic field that is capable of substantially canceling the fringing field (inherent - where shields capable of cancelling magnetic fields induced just outside the surface of the cores as described in para [0047] have characteristics capable of supporting electric currents capable of inducing a magnetic field capable of substantially cancelling the fringing field).

Regarding claim 7, Dobbs further discloses wherein, during cancellation of the fringing field by the shield, an image current flowing in the shield produces a magnetic field that is capable of canceling the fringing field (inherent - where shields capable of cancelling magnetic fields induced just outside the surface of the cores as described in para [0047] carries a current that produces a magnetic field capable of substantially cancelling the fringing field).

Regarding claim 8, Dobbs further discloses wherein the net image current in the shield flows substantially circumferentially about the axis of rotation during cancellation of the fringing field by the shield (where currents flow in circles as described in para [0048]).

Regarding claim 9, Dobbs further discloses wherein the overall configuration of the shielded power coupling device is substantially axisymmetric (Fig. 6A), and the net image current in the shield flows substantially circumferentially about the axis of axisymmetry during cancellation of the fringing field by the shield (current flow described in para [0048]).

Regarding claim 10, Dobbs further discloses wherein the overall configuration of the shielded power coupling device is substantially toroidal (where use of two half toroidal shells as described in para [0048] would result in a substantially toroidal shaped device), and the net image current in the shield flows substantially along a circle coaxial with a major circle thereof during cancellation of the fringing field by the shield (para [0048]).

Regarding claim 11, Dobbs further discloses wherein, during cancellation of the fringing field by the shield, a net image current flows in the shield that is substantially equal in magnitude but opposite in sign to the net electric current flowing through the windings (inherent - where cancellation of magnetic fields induced just outside the surface of the cores as described in para [0047] necessarily requires a current that is equal in magnitude but in opposite in sign to the current being cancelled).

Regarding claim 15, Dobbs further discloses wherein thickness of the shield in the region of the core airgap is sufficient to achieve an electrical conductivity equivalent to that of aluminum in a thickness of not less than five core airgap thicknesses (see thickness of air gap 150 as compared with shield in Fig. 2A where shields are made to be quite thick as described in para [0049]).

Regarding claim 16, Dobbs further discloses wherein thickness of the shield in the region of the core airgap is sufficient to achieve an electrical conductivity equivalent to that of aluminum in a thickness of not less than ten core airgap thicknesses (see thickness of air gap 150 as compared with shield in Fig. 2A where shields are made to be quite thick as described in para [0049]).

Regarding claim 17, Dobbs further discloses wherein the shield is a multipartite shield (where shields are two continuous rings as described in para [0050]) having a shield airgap (see gap between shield 310 and winding 220 in Fig. 6B) permitting relative movement during operation of the shielded power coupling device (inherent - where cores rotating as described in para [0028] with use of shields in para [0015] would allow relative movement between the shields and cores).

Regarding claim 23, Dobbs further discloses wherein, during operation of the shielded power coupling device, the net electric current flowing through the windings is substantially zero (inherent - where cancelling of magnetic fields induced just outside the surface of the cores as described in para [0047] results because of a substantially zero net electric current).

Regarding claim 25, Dobbs further discloses wherein the secondary core recesses are disposed opposite the primary core recesses and are spaced apart therefrom (see Fig. 1).

Regarding claim 26, Dobbs further discloses wherein the recesses are substantially annular (use of substantially annular recesses in para [0010]).

Regarding claim 27, Dobbs further discloses wherein the cores are of substantially semitoroidal configuration (where cores are preferably semi-toroidal as described in para [0011]).

Regarding claim 28, Dobbs further discloses wherein the primary core and the secondary core are of substantially axisymmetric configuration with mutually collinear axes of symmetry thereof being collinear with the axis of rotation (Fig. 1).

Regarding claim 29, Dobbs further discloses wherein, during operation of the shielded power coupling device, the core airgap sweeps out a volume in space of configuration substantially corresponding to one or more species selected from among the group consisting of planar configuration, cylindrical configuration, and conical configuration (see core airgap 150 in Fig. 1 where rotation would sweep out a volume in a cylindrical configuration).

Regarding claim 30, Dobbs further discloses wherein a volume in space swept out by the core airgap during operation of the shielded power coupling device is of substantially planar configuration and intervenes axially with respect to the axis of rotation between the primary core and the secondary core (where rotation of arrangement in Fig. 2B would produce a substantially planar configuration of volume swept out by the core airgap intervening axially with respect to the axis of rotation between the primary core and the secondary core).

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Regarding claim 31, Dobbs further discloses wherein a volume in space swept out by the core airgap during operation of the shielded power coupling device is of substantially cylindrical configuration (see core airgap 150 in Fig. 1 where rotation would sweep out a volume in a cylindrical configuration) and intervenes radially with respect to the axis of rotation between the primary core and the secondary core (see orientation of core airgap 150, primary core 100 and secondary core 200 in Fig. 1).

Regarding claim 33, Dobbs further discloses wherein the shield is of substantially axisymmetric configuration with axis of symmetry thereof being collinear with the axis of rotation (see shields 300 and 310 in Fig. 6A).

Regarding claim 34, Dobbs further discloses wherein loops of magnetic flux linking the primary core and the secondary core during operation of the shielded power coupling device lie in substantially meridional planes with respect to the axis of rotation (inherent - where rotation of primary core in Fig. 1 would produce loops of magnetic flux that lie in substantially meridional planes with respect to the axis of rotation).

Regarding claim 35, Dobbs further discloses mutually opposed core surfaces separated by the core airgap are substantially smooth (Fig. 1), substantially mutually parallel (Fig. 1), and substantially normal to the predominant direction of magnetic flux lines bridging the mutually opposed core surfaces during operation of the shielded power coupling device (Fig. 1).

Regarding claim 36, Dobbs further discloses wherein the overall configuration of the shielded power coupling device is substantially toroidal, (use of shells having semi-toroidal configurations in para [0015] would produce an overall configuration having a toroidal shape) loops of magnetic flux linking the primary core and the secondary core during operation of the shielded power coupling device lying substantially in planes of minor circles thereof (inherent - see Fig. 1 where oscillating magnetic fields formed just outside gap between primary and secondary cores as described in para [0015] would lie substantially in planes of minor circles thereof).

Regarding claim 37, Dobbs further discloses wherein, as viewed in a meridional section with respect to the axis of rotation, except for lines of magnetic flux that are responsible for presence of the fringing field, lines of magnetic flux linking the primary core and the secondary core during operation of the shielded power coupling device bridge the core airgap so as to be normal to an imaginary surface bounding a volume in space swept out by the core airgap during operation of the shielded power coupling device (inherent - where operation of device in member in Fig. 2A necessarily generates magnetic flux lines linking the primary and secondary core that are normal to an imaginary surface bounding a volume swept out by the core airgap).

Regarding claim 38, Dobbs further discloses wherein the primary core and the secondary core each comprise a plurality of core segments arranged in substantially mutually adjacent fashion (Fig. 2A) so as to collectively approximate a substantially axisymmetric configuration (Fig. 2A).

Regarding claim 39, Dobbs further discloses wherein at each the primary core and the secondary core, the core segments are arranged such that space intervening between mutually adjacent segments in a circumferential direction with respect to the axis of rotation is not more than the width of one of the core segments in the circumferential direction (see Fig. 2A).

Regarding claim 40, Dobbs further discloses wherein at each the primary core and the secondary core, the core segments are arranged such that space intervening between mutually adjacent segments in a circumferential direction with respect to the axis of rotation is not more than one-half of the width of one of the core segments in the circumferential direction (Fig. 2A).

Regarding claim 52, Dobbs discloses a shielded power coupling device (para [0015]) comprising:
a shield having at least one airgap permitting relative rotation between the primary winding and the secondary winding (see shield 300 in Fig. 6A and airgap 150 in Fig. 2A);
a primary winding (see winding 120 in Fig. 1 as described in para [0027])
i) having substantially axisymmetric configuration (Fig. , and
ii) defining a circumferential direction (see winding 120 in Fig. 1);
a secondary winding (see winding 220 in Fig. 1 as described in para [0027])
i) having substantially axisymmetric configuration (see winding 220 in Fig. 1),
ii) substantially concentric with or lying in a plane substantially parallel to a plane containing the circumferential direction (Fig. 1),
iii) capable of rotating relative to the primary winding (para [0009]), and
iv) inductively coupled to the primary winding (para [0027]); and
d) wherein the shield supports flow of electric current in the circumferential direction (inherent - where shield in Fig. 2A would support flow of electric current in the circumferential direction when current is passed through conductive windings as described in para [0015]).

Regarding claim 53, Dobbs discloses a shielded power coupling device (para [0015]) comprising:
a) at least two substantially arcuate windings arranged in mutually radially and/or axially displaced fashion relative to an approximate major circle of an imaginary toroid (see windings 120 and 220 in Fig. 1 as described in para [0027]); and
b) at least one electrically conductive shield encircling and/or encircled by the windings (see shield 300 in Fig. 6A);
c) wherein, upon application of an alternating electric current to at least one of the windings, flux lines linking at least a portion of the windings lie substantially in planes of minor circles of the imaginary toroid (inherent - where application of current to one of the windings in Fig. 1 necessarily produces flux lines linking at least a portion of the windings lying substantially in planes of minor circles of the imaginary toroid); and,
d) the shield supports flow of electric current along a direction of a circle coaxial with the major circle of the imaginary toroid sufficient to induce a magnetic field capable of substantially canceling a magnetic field due to a net electric current flowing in the windings upon application of the alternating electric current to at least one of the windings (where radiation leakage is prevented as described in para [0050]).

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Regarding claim 54, Dobbs discloses a shielded power coupling device (para [0015]) transferring electric power between a stationary subsystem and a rotatable subsystem (para [0009]) that is inductively coupled to (para [0033]) and arranged in close proximity to the stationary subsystem (Fig. 4A and 4B) and that, during operation of the shielded power coupling device, is capable of rotating about an axis of rotation which is also substantially an axis of symmetry for both the stationary subsystem and the rotating subsystem (rotation of cores about a common axis as described in para [0028]), the shielded power coupling device comprising:
a) inductive field generating means for converting electric power to an inductive coupling field (inherent - where power coupling device 10 in Fig. 1 and 2A - 2B as described in para [0037] would include a generating element);
b) inductive coupling field receiving means for converting the inductive coupling field to electric power (inherent - where power coupling device 10 in Fig. 1 and 2A - 2B as described in para [0037] would include a receiving element);
c) inductive coupling efficiency increasing means for increasing inductive coupling between the inductive field generating means and the inductive coupling field receiving means (use of ferrite cores surrounding each winding in para [0017] which applicant considers capable of increasing inductive coupling); and
d) shielding means peripheral to the inductive coupling efficiency increasing means (see shields 300 and 310 in Fig. 6A and 6B described in para [0048]) for substantially eliminating leakage of electromagnetic radiation from the shielded power coupling device (leakage prevented as described in para [0050]) when the shielded power coupling device is operated at power levels exceeding 25 kW (use of coupling device at 75 kW in para [0040]).

Regarding claim 55, Dobbs discloses a method for transferring electric power between a stationary subsystem and a rotatable subsystem (para [0009]) that is inductively coupled to (para [0033]) and arranged in close proximity to the stationary subsystem (Fig. 4A and 4B) and that, during operation of the shielded power coupling device, is capable of rotating about an axis of rotation which is also substantially an axis of symmetry for both the stationary subsystem and the rotating subsystem (rotation of cores about a common axis as described in para [0028]), the method comprising:
a) using an inductive field generating element to convert electric power to an inductive coupling field (inherent - where power coupling device 10 in Fig. 1 and 2A - 2B as described in para [0037] would include a generating element);
b) using an inductive coupling field receiving element to convert the inductive coupling field to electric power (inherent - where power coupling device 10 in Fig. 1 and 2A - 2B as described in para [0037] would include a receiving element);
c) using an inductive coupling efficiency increasing element to increase inductive coupling between the inductive field generating element and the inductive coupling field receiving element (use of ferrite cores surrounding each winding in para [0017] which applicant considers capable of increasing inductive coupling); and
d) using shielding peripheral to the inductive coupling efficiency increasing element (see shields 300 and 310 in Fig. 6A and 6B described in para [0048]) to substantially eliminate leakage of electromagnetic radiation from the shielded power coupling device (leakage prevented as described in para [0050]) when the shielded power coupling device is operated at power levels exceeding 2.5 kW (use of coupling device at 5 kW in para [0040]).

Regarding claim 56, Dobbs discloses a flux-aligning core set (see cores 100 and 200 in Fig. 1) for use with one or more windings (see windings 120 and 220 in Fig. 1) and one or more shields (see shields 300 and 310 in Fig. 6A), the core set comprising:
a) a plurality of flux-aligning core segments (see cores 100 and 200 in Fig. 1), each of which
i) is composed of one or more substances having reluctance lower than that of air (cores made of magnetically permeable material including ferrite, silicon iron, nickel ion alloy, stainless steel, and cobalt iron alloy as described in para [0028] which have a reluctance lower than that of air) and
ii) has at least two arm-like members (Fig. 1);
b) wherein the plurality of flux-aligning core segments are arranged in substantially axisymmetric fashion (Fig. 1) such that
i) at least one of the winding or windings can be routed along one or more circumferentially oriented cradle-like recesses formed by cooperation of at least two of the two or more arm-like members of each of at least a portion of the plurality of flux-aligning core segments (see winding 120 in recess 110 of core 100 in Fig. 1); and
ii) when at least two of the two or more arm-like members of each of at least a portion of the plurality of flux-aligning core segments are arranged in mutual opposition across an airgap (see core members 100 and 200 in relation to airgap 150 in Fig. 1) with at least two armlike members of each of at least a portion of a counterpart plurality of core segments of a counterpart core set that is substantially a reflection of the flux-aligning core set across the airgap (see core members 100 and 200 across airgap 150 in Fig. 1), at least a portion of the flux-aligning core segments and at least a portion of the counterpart core segments cooperate to complete or lower reluctance of a multiplicity of magnetic paths
1) passing through the flux-aligning core set and the counterpart core set to bridge the airgap (inherent - where operation of device in Fig. 1 with aligned core segments would lower reluctance of magnetic paths passing through the flux-aligning core set and the counterpart core set to bridge the airgap), and
2) substantially lying in meridional planes relative to the axis of axisymmetry (inherent - where operation of device in Fig. 1 with aligned core segments would lower reluctance of magnetic paths substantially lying in meridional planes relative to the axis of axisymmetry).

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Regarding claim 57, Dobbs discloses a passage-containing core segment (see cores 100 and 200 in Fig. 1) composed of one or more substances having reluctance lower than that of air (cores made of magnetically permeable material including ferrite, silicon iron, nickel ion alloy, stainless steel, and cobalt iron alloy as described in para [0028] which have a reluctance lower than that of air) and comprising:
a) one or more passages permitting passage of one or more windings therethrough (see passage of winding 120 through core in Fig. 2A); and
b) two or more arm-like members creating one or more cradle-like recesses therebetween along which at least one of the winding or windings can be routed (see core 100 with passage 110 for winding 120 in Fig. 1);
c) wherein at least one of the passage or passages is disposed on the passage containing core segment in at least one location such that, when at least two of the two or more arm-like members of the passage-containing core segment are arranged in mutual opposition across an airgap with at least two arm-like members of a first counterpart core segment that is substantially a reflection of the passage-containing core segment across the airgap, reluctance of a magnetic path passing through the passage-containing core segment and the first counterpart core segment to bridge the airgap is not substantially different than what the reluctance of the magnetic path would be were there no passage in the passage-containing core segment (inherent - where alignment of passages shown in Fig. 2A would have a reluctance of a magnetic path passing through the passage containing core segment and counterpart core segment that is not substantially different than what the reluctance would be were there no passage in the core segment.

Regarding claim 58, Dobbs discloses a system including a shielded inductive power coupling device (para [0015]), the system comprising:
a) a stationary member (para [0009]);
b) a rotatable member (para [0009]) inductively coupled to the stationary member (para [0033]);
c) a power source (para [0051]); and
d) a shielded inductive power coupling device responsive to the power source and capable of transmitting power from the power source to at least one of the stationary member and the rotatable member (para [0051]), the inductive power coupling device comprising:
i) a primary reluctance-.decreasing core defining a primary core recess (see primary core 100 with recess 110 in Fig. 1);
ii) a secondary reluctance-decreasing core defining a secondary core recess and disposed adjacent the primary core (see secondary core 200 with recess 210 in Fig. 1);
iii) a primary electrically conductive winding disposed within the primary core recess (see winding 120 in Fig. 1);
iv) a secondary electrically conductive winding disposed within the secondary core recess (see winding 220 in Fig. 1); and
v) an electrically conductive shield (see shields 300 and 310 in Fig. 6A);
vi) wherein the primary and secondary cores are arranged so as to form a core airgap therebetween permitting relative rotation of the cores about an axis of rotation (see airgap 150 in Fig. 1);
vii) a primary electric current flowing through the primary winding produces a secondary electric current flowing through the secondary winding (para [0033]), creating a fringing field at the periphery of the core airgap (para [0033]); and
viii) the shield is capable of substantially canceling the fringing field (where shields cancel magnetic fields induced just outside the surface of the cores as described in para [0047]).

Regarding claim 59, Dobbs further discloses wherein:
a) the system is a CT scanner (para [0051]);
b) the stationary member comprises a stationary gantry in the CT scanner (para [0051]); and
c) the rotatable member includes an x-ray source (para [0051]).

Claims 12-14 and 18-22 lack an inventive step under PCT Article 33(3) as being obvious over Dobbs in view of US 6,794,792 B2 (Wang).

Regarding claim 12, Dobbs discloses the shielded power coupling device of claim 2.
Dobbs further discloses wherein the shield is a single-part shield (where shields 300 and 310 are continuous rings covering the entire structure as described in para [0050]).
Wang discloses a rotor and housing (col. 1, ln. 7-10) including:
a shield airgap that is substantially nonadjacent with respect to the core air gap (see gap 76 adjacent to shield 46 in Fig. 4 as described in col. 5, ln. 66 - col. 6, ln. 6).
It would have been obvious to a person of ordinary skill in the art to combine the airgap and shield arrangement of Wang with the shielded power coupling device of Dobbs because Dobbs discloses a the use of an airgap (para [0028]) and shield (para [0046]) while Wang discloses that using a gap adjacent to the shield would help to reduce heat flow from the rotor through the shield (col. 5, ln. 66 - col. 6, ln. 6).

Regarding claim 13, Dobbs and Wang disclose the shielded power coupling device in accordance with claim 12.
Dobbs further discloses a core airgap (see core airgap 150 in Fig. 1) and Wang discloses a shield airgap (col. 5, ln. 66 - col. 6, ln. 6), but Dobbs and Wang do not specifically disclose wherein as measured in a direction perpendicular to an imaginary surface bounding the volume of space swept out by the core airgap during operation of the shielded power coupling device, the shield airgap is not less than three core airgap thicknesses from the core airgap.
It would have been obvious to a person of ordinary skill in the art to vary the dimensions of the device and air gaps in order to manufacture devices of varying size while still providing the fringing field cancellation effect.

Regarding claim 14, Dobbs and Wang disclose the shielded power coupling device in accordance with claim 12.
Dobbs further discloses a core airgap (see core airgap 150 in Fig. 1) and Wang discloses a shield airgap (col. 5, ln. 66 - col. 6, ln. 6), but Dobbs and Wang do not specifically disclose wherein, as measured in a direction perpendicular to an imaginary surface bounding the volume of space swept out by the core airgap during operation of the shielded power coupling device, the shield airgap is not less than five core airgap thicknesses from the core airgap.
It would have been obvious to a person of ordinary skill in the art to vary the dimensions of the device and air gaps in order to manufacture devices of varying size while still providing the fringing field cancellation effect.

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Regarding claim 18, Dobbs discloses the shielded power coupling device in accordance with claim 17.
Dobbs further discloses a core airgap (see core airgap 150 in Fig. 2A).
Wang further discloses a shield airgap (see gap 76 adjacent to shield 46 in Fig. 4 as described in col. 5, ln. 66 - col. 6, ln. 6), however Dobbs and Wang do not specifically disclose wherein the shield airgap is substantially adjacent the core airgap.
It would have been obvious to a person of ordinary skill in the art to combine the airgap and shield arrangement of Wang with the shielded power coupling device of Dobbs because Dobbs discloses a the use of an airgap (para [0028]) and shield (para [0046]) while Wang discloses that using a gap adjacent to the shield would help to reduce heat flow from the rotor through the shield (col. 5, ln. 66 - col. 6, ln. 6).
It would have further been obvious to a person of ordinary skill in the art to locate the shield airgap substantially adjacent the core airgap because a shield airgap adjacent to the entire shield would necessarily have some portion adjacent the core airgap.

Regarding claim 19, Dobbs further discloses wherein thickness of the shield in the region of the core airgap is sufficient to achieve an electrical conductivity equivalent to that of aluminum in a thickness of not less than five core airgap thicknesses (see thickness of air gap 150 as compared with shield in Fig. 2A where shields are made to be quite thick as described in para [0049]).

Regarding claim 20, Dobbs further discloses wherein thickness of the shield in the region of the core airgap is sufficient to achieve an electrical conductivity equivalent to that of aluminum in a thickness of not less than ten core airgap thicknesses (see thickness of air gap 150 as compared with shield in Fig. 2A where shields are made to be quite thick as described in para [0049]).

Regarding claim 21, Dobbs further discloses wherein thickness of the shield in the region of the core airgap is sufficient to achieve an electrical conductivity equivalent to that of aluminum in a thickness of not less than two shield airgap thicknesses (see thickness of air gap 150 as compared with shield in Fig. 2A where shields are made to be quite thick as described in para [0049]).

Regarding claim 22, Dobbs further discloses wherein thickness of the shield in the region of the core airgap is sufficient to achieve an electrical conductivity equivalent to that of aluminum in a thickness of not less than four shield airgap thicknesses (see thickness of air gap 150 as compared with shield in Fig. 2A where shields are made to be quite thick as described in para [0049]).

Claim 24 lacks an inventive step under PCT Article 33(3) as being obvious over Dobbs in view of US 4,293,884 A (Schiller)

Regarding claim 24, Dobbs discloses the shielded power coupling device in accordance with claim 2.
Dobbs further discloses wherein:
e) during operation of the shielded power coupling device, the instantaneous net electric current flowing through the primary windings is substantially zero (inherent - where cancelling of magnetic fields induced just outside the surface of the cores as described in para [0047] results because of a substantially zero net electric current).
Schiller discloses a magnetic transducer (col. 1, ln. 6-11) wherein:
a) the primary core further defines a second primary core recess (Fig. 5) ;
b) the secondary core further defines a second secondary core recess (Fig. 5);
c) the shielded power coupling device further comprises:
i) a second electrically conductive primary winding disposed substantially within the second primary core recess (see windings 112 in Fig. 5); and
ii) a second electrically conductive secondary winding disposed substantially within the second secondary core recess (see windings 114 in Fig. 5);
d) wherein a second primary electric current flowing through the second primary winding produces a second secondary electric current flowing through the second secondary winding (inherent - where use of the device as described in col. 7, ln. 58-61 necessarily produces a secondary electric current flowing through second secondary winding 114 from a second primary electric current flowing through the second primary winding 112 in Fig. 5).
It would have been obvious to a person of ordinary skill in the art to combine the magnetic transducer of Schiller with the shielded power coupling device of Dobbs in order to provide shielding as disclosed in Dobbs to the E-core type device disclosed in Schiller.

Claim 32 lacks an inventive step under PCT Article 33(3) as being obvious over Dobbs in view of US 5,191,309 A (Laros).

Regarding claim 32, Dobbs discloses the shielded power coupling device in accordance with claim 2.
Laros discloses a rotary transformer (col. 1, ln. 5-18) wherein a volume in space swept out by the core airgap during operation of the shielded power coupling device is of substantially conical configuration (see airgap 7 in Fig. 1 that would sweep out a conical configuration when rotated around common axis 9 as described in col. 2, ln. 65 - col. 3, ln. 4) and intervenes both axially and radially with respect to the axis of rotation between the primary core and the secondary core (where volume in space would intervene both axially and radially with respect to axis of rotation between inner core portion 3 and outer core portion 5 in Fig. 1).
It would have been obvious to a person of ordinary skill in the art to combine the conical configuration of Laros with the device of Dobbs in order to provide shielding to the Laros device.

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Supplemental Box

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Continuation of:
Box V. 2. Citations and explanations:

Claims 41-48 lack an inventive step under PCT Article 33(3) as being obvious over Dobbs in view of US 4,335,423 A to Koizumi et al. (hereinafter Koizumi).

Regarding claim 41 Dobbs discloses the shielded power coupling device in accordance with claim 38.
Dobbs further discloses wherein at least one of the core segments has a passageway (see Fig. 2A), however Dobbs does not specifically disclose wherein at least one of the core segments has a passageway permitting passage therethrough of a lead wire for at least one of the windings.
Koizumi discloses a transformer (col. 1, ln. 6-8) including a lead wire for at least one of the windings (see lead wire 25 connected to winding 13a' in Fig. 4 as described in col. 4, ln. 62-67), however Koizumi does not specifically disclose wherein at least one of the core segments has a passageway permitting passage therethrough of a lead wire for at least one of the windings.
It would have been obvious to a person of ordinary skill in the art to run the lead wire of Koizumi through the passageway of Dobbs in order to prove a means for electrically connecting the shielded power coupling device of Dobbs to a power source or load.

Regarding claim 42, Dobbs and Koizumi disclose the shielded power coupling device in accordance with claim 41, however Dobbs and Koizumi do not specifically disclose wherein the passageway is disposed on the core segment at such location and in such manner as to not substantially alter reluctance of the path taken by magnetic lines of flux therethrough during operation of the power coupling device.
It would have been obvious to a person of ordinary skill in the art to vary the location of the passageway through experimentation and design choice so as to not substantially alter reluctance of the path taken by magnetic lines of flux therethrough during operation of the power coupling device which would reduce interference with the magnetic flux cancellation of Dobbs.

Regarding claim 43, Dobbs and Koizumi disclose the shielded power coupling device in accordance with claim 41, however Dobbs and Koizumi do not specifically disclose wherein the passageway is disposed on the core segment at a location other than a core-airgap interface.
It would have been obvious to a person of ordinary skill in the art to vary the location of the passageway through experimentation and design choice in order to provide a convenient access point while allowing maintaining the magnetic flux cancellation characteristics of a shielded device.

Regarding claim 44, Dobbs and Koizumi disclose the shielded power coupling device in accordance with claim 41, however Dobbs and Koizumi do not specifically disclose wherein the passageway is disposed on the core segment at a location on the core segment which is a back face that is a farthest surface thereof from the core airgap.
It would have been obvious to a person of ordinary skill in the art to vary the location of the passageway through experimentation and design choice in order to provide a convenient access point while allowing maintaining the magnetic flux cancellation characteristics of a shielded device.

Regarding claim 45 Dobbs discloses the shielded power coupling device in accordance with claim 38.
Dobbs further discloses passageways permitting passage of at least one pair of lead wires (see Fig. 2A), however Dobbs does not specifically disclose wherein passageways permitting passage of at least one pair of lead wires for at least one of the windings are disposed in kitty-comer fashion on mutually adjacent core segments.
Koizumi discloses a transformer (col. 1, ln. 6-8) including a pair of lead wires for at least one of the windings (see lead wires 25 and 25' connected to winding 13a' in Fig. 4 as described in col. 4, ln. 62-67), however Koizumi does not specifically disclose wherein passageways permitting passage of at least one pair of lead wires for at least one of the windings are disposed in kitty-comer fashion on mutually adjacent core segments.
It would have been obvious to a person of ordinary skill in the art to run the lead wires of Koizumi through the passageway of Dobbs in order to prove a means for electrically connecting the shielded power coupling device of Dobbs to a power source or load.
It would have further been obvious to a person of ordinary skill in the art to vary the location of the passageways through experimentation and design choice in order to provide a convenient access point while allowing maintaining the magnetic flux cancellation characteristics of a shielded device.

Regarding claim 46 Dobbs discloses the shielded power coupling device in accordance with claim 38.
Dobbs further discloses passageways permitting passage of at least one pair of lead wires (see Fig. 2A), however Dobbs does not specifically disclose wherein passageways permitting passage of at least one pair of lead wires for at least one of the windings are disposed on the same core segment at diagonally opposed locations at either end thereof in the direction in which at least one of the windings is wound within at least one of the recesses.
Koizumi discloses a transformer (col. 1, ln. 6-8) including a pair of lead wires for at least one of the windings (see lead wires 25 and 25' connected to winding 13a' in Fig. 4 as described in col. 4, ln. 62-67), however Koizumi does not specifically disclose wherein passageways permitting passage of at least one pair of lead wires for at least one of the windings are disposed on the same core segment at diagonally opposed locations at either end thereof in the direction in which at least one of the windings is wound within at least one of the recesses.
It would have been obvious to a person of ordinary skill in the art to run the lead wires of Koizumi through the passageway of Dobbs in order to prove a means for electrically connecting the shielded power coupling device of Dobbs to a power source or load.
It would have further been obvious to a person of ordinary skill in the art to vary the location of the passageways through experimentation and design choice in order to provide a convenient access point while allowing maintaining the magnetic flux cancellation characteristics of a shielded device.

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WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

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PCT/US 08/52326

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of:
Box V. 2. Citations and explanations:

Regarding claim 47 Dobbs discloses the shielded power coupling device in accordance with claim 2.
Dobbs further discloses a shield configuration to cancel oscillating magnetic fields (para [0015]) but does not specifically disclose wherein lead wires of the first primary winding pass through the primary core in such fashion and at such locations as will substantially minimize magnetic field of a virtual current loop formed in part by the first primary winding lead wires.
Koizumi discloses a transformer (col. 1, ln. 6-8) including a pair of lead wires for at least one of the windings (see lead wires 25 and 25' connected to winding 13a' in Fig. 4 as described in col. 4, ln. 62-67), however Koizumi does not specifically disclose wherein lead wires of the first primary winding pass through the primary core in such fashion and at such locations as will substantially minimize magnetic field of a virtual current loop formed in part by the first primary winding lead wires.
It would have been obvious to a person of ordinary skill in the art to combine the lead wires of Koizumi with the device of Dobbs in order to prove a means for electrically connecting the shielded power coupling device of Dobbs to a power source or load.
It would have further been obvious to a person of ordinary skill in the art to vary the location of the passageways through experimentation and design choice in order to provide a convenient access point while allowing maintaining the magnetic flux cancellation characteristics of a shielded device.

Regarding claim 48 Dobbs discloses the shielded power coupling device in accordance with claim 2.
Dobbs further discloses a shield configuration to cancel oscillating magnetic fields (para [0015]) but does not specifically disclose wherein lead wires of the secondary winding pass through the first secondary core in such fashion and at such locations as will substantially minimize magnetic field of a virtual current loop formed in part by the first secondary winding lead wires.
Koizumi discloses a transformer (col. 1, ln. 6-8) including a pair of lead wires for at least one of the windings (see lead wires 25 and 25' connected to winding 13a' in Fig. 4 as described in col. 4, ln. 62-67), however Koizumi does not specifically disclose wherein lead wires of the secondary winding pass through the first secondary core in such fashion and at such locations as will substantially minimize magnetic field of a virtual current loop formed in part by the first secondary winding lead wires.
It would have been obvious to a person of ordinary skill in the art to combine the lead wires of Koizumi with the device of Dobbs in order to prove a means for electrically connecting the shielded power coupling device of Dobbs to a power source or load.
It would have further been obvious to a person of ordinary skill in the art to vary the location of the passageways through experimentation and design choice in order to provide a convenient access point while allowing maintaining the magnetic flux cancellation characteristics of a shielded device.

Claims 49-51 lack an inventive step under PCT Article 33(3) as being obvious over Dobbs in view of US 2006/0208727 A1 to Matsumoto et al. (hereinafter Matsumoto).

Regarding claim 49, Dobbs discloses the shielded power coupling device in accordance with claim 2, however Dobbs does not specifically disclose wherein misaligned magnetic flux including that due to the fringing field and any virtual current loops is not more than 1/100th of total magnetic flux linking the cores during operation of the shielded power coupling device.
Matsumoto discloses a sensor having an increase area of aligned magnetic flux (para [0075]) but does not specifically disclose wherein misaligned magnetic flux including that due to the fringing field and any virtual current loops is not more than 1/100th of total magnetic flux linking the cores during operation of the shielded power coupling device.
It would have been obvious to a person of ordinary skill in the art to combined the aligned magnetic flux of Matsumoto with the device of Dobbs in order to improve the shielding effect of the device in Dobbs.
It would have further been obvious to a person of ordinary skill in the art to vary the precision of alignment through experimentation and design choice in order to produce a device with low misaligned magnetic flux balanced against the increased costs that such precision would require.

Regarding claim 50, Dobbs discloses the shielded power coupling device in accordance with claim 2, however Dobbs does not specifically disclose wherein misaligned magnetic flux including that due to the fringing field and any virtual current loops is not more than l/1,000th of total magnetic flux linking the cores during operation of the shielded power coupling device.
Matsumoto discloses a sensor having an increase area of aligned magnetic flux (para [0075]) but does not specifically disclose wherein misaligned magnetic flux including that due to the fringing field and any virtual current loops is not more than l/1,000th of total magnetic flux linking the cores during operation of the shielded power coupling device.
It would have been obvious to a person of ordinary skill in the art to combined the aligned magnetic flux of Matsumoto with the device of Dobbs in order to improve the shielding effect of the device in Dobbs.
It would have further been obvious to a person of ordinary skill in the art to vary the precision of alignment through experimentation and design choice in order to produce a device with low misaligned magnetic flux balanced against the increased costs that such precision would require.

Regarding claim 51, Dobbs discloses the shielded power coupling device in accordance with claim 2, however Dobbs does not specifically disclose wherein misaligned magnetic flux including that due to the fringing field and any virtual current loops is not more than 1/10,000th of total magnetic flux linking the cores during operation of the shielded power coupling device.
Matsumoto discloses a sensor having an increase area of aligned magnetic flux (para [0075]) but does not specifically disclose wherein misaligned magnetic flux including that due to the fringing field and any virtual current loops is not more than 1/10,000th of total magnetic flux linking the cores during operation of the shielded power coupling device.
It would have been obvious to a person of ordinary skill in the art to combined the aligned magnetic flux of Matsumoto with the device of Dobbs in order to improve the shielding effect of the device in Dobbs.
It would have further been obvious to a person of ordinary skill in the art to vary the precision of alignment through experimentation and design choice in order to produce a device with low misaligned magnetic flux balanced against the increased costs that such precision would require.

Claims 1-59 have industrial applicability as defined by PCT Article 33(4) because the subject matter can be made or used in industry.

INTERNATIONAL SEARCH REPORT

International application No. PCT/US 08/52326

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - H01F 21/06 (2008.04)
USPC - 336/130
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8): H01F 21/06 (2008.04)
USPC: 336/130

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
All Prior Art Databases (text search - see terms below) USPC: 336/84R, 84C, 87, 130-132, 229 (text search - see terms below)Information Disclosure Statement for US Patent Application 11/699,529

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PubWEST (PGPB,USPT,USOC,EPAB,JPAB); Google Scholar; Google Patents; FreePatentsOnline
Search Terms: air, aligned, cancel$4, conical, core, coupl$3, current, efficien$4, ferrite, field, flux, gap, increasing, inductive, leak$3, magnetic, misalignment, net, power, primary, recess, secondary, shield$3, toroidal, winding

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 2006/0022785 A1 (DOBBS) 02 February 2006 (02.02.2006), entire document especially FIG. 1, FIG. 2A, FIG. 2B, FIG. 3, FIG 6A, FIG. 6B, para [0009], [0015], [0017], [0028], [0033], [0037], [0040], [0046], [0047], [0048], [0050]	1-11, 15-17, 23, 25-31, 33-40 and 52-59 --- 12-14, 18-22, 24, 32, 41-51
Y	US 6,794,792 B2 (WANG) 21 September 2004 (21.09.2004), entire document especially FIG. 4, col. 1, ln. 7-10, col. 5, ln. 66 - col. 6, ln. 6	12-14, 18-22
Y	US 4,293,884 A (SCHILLER) 06 October 1981 (06.10.1981), FIG. 5, col. 1, ln. 6-11, col. 7, ln. 58-61	24
Y	US 5,191,309 A (LAROS) 02 March 1993 (02.03.1993), FIG. 1, col. 1, ln. 5-18, col. 2, ln. 65 - col. 3, ln. 4	32
Y	US 4,335,423 A (KOIZUMI et al.) 15 June 1982 (15.06.1982), FIG. 4, col. 1, ln. 6-8, col. 4, ln. 62 -67	41-48
Y	US 2006/0208727 A1 (MATSUMOTO) 21 September 2006 (21.09.2006), para [0075]	49-51

☐ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
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Date of the actual completion of the international search	Date of mailing of the international search report
30 June 2008 (30.06.2008)	08 JUL 2008

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